3 Water Resources

3.1 Historical Perspective on Water Resources at Ware River

The community of Boston commenced its search for clean water in 1652, when the General Court of the Massachusetts Bay Colony incorporated the Water Works Company. Under the Company's direction, water was delivered to Boston from wells through wooden pipes to a wooden storage reservoir from which water was distributed throughout the community. By the late 18th Century, this system was no longer adequate to supply the needs of the expanding population. Consequently, the supply system was extended to Jamaica Pond in Roxbury.

Water supply problems continued to plague the city throughout the 19th Century. Expansion of the supply system was initiated only after the supply needs became critical. By the 1830s the system was inadequate, and the decision was made to expand. In 1849, an aqueduct was completed to deliver water to the city from Lake Cochituate in Natick. The system was expanded again in 1873, with the completion of an aqueduct to bring water from the Sudbury River into the supply system.

1870 - 1890 was a period of rapid growth for the City of Boston and the surrounding municipalities. The demand for high quality drinking water grew beyond the system's capacity. In 1893, the legislature directed the State Board of Health to develop plans to expand the supply system. Three alternatives were investigated: Lake Winnipesauke in New Hampshire, the Merrimac River, and the Nashua River above Clinton. After careful consideration, Winnipesauke was eliminated because of the potential difficulties of dealing with another state. The Merrimac Plan was abandoned due to inferior water quality. Consequently, in 1895, the board recommended that the Nashua River above Clinton be developed as an additional water supply. The report called for the construction of a dam in the Town of Clinton and an aqueduct connecting the proposed reservoir with the Sudbury system. This report led to the formation of the Metropolitan Water Board and the implementation of construction plans. Upon completion in 1908, the new dam created the Wachusett Reservoir. The Wachusett Reservoir had a capacity of sixty-three billion gallons, and the aqueduct had the capacity to deliver 300,000 gallons of water daily.

It was obvious by 1919 that the system could not indefinitely continue to supply the growing water needs of the Metropolitan Water District. The legislature recommended that the Boston Metropolitan Water District investigate potential supplies, resulting in the 1922 Goodnough Plan. This plan recommended the construction of an aqueduct from Wachusett Reservoir into the Ware River valley to divert the flood flows of the Ware to Wachusett. It went on to recommend the construction of a dam to impound the waters of the Swift River and the extension of the Wachusett-Coldbrook Aqueduct into the Swift River valley. It further advised that the system be expanded to the Millers and Connecticut Rivers. It was felt that this would provide a sufficient supply of water to the Metropolitan Water District for the foreseeable future.

There was considerable opposition to this plan in the Western part of the state. From 1925 until 1927, the plan was debated and reexamined. In 1927, the legislature enacted Chapter 321 of the Acts of 1927, approving the Goodnough Plan with the exception of Millers and Connecticut diversions and paving the way for the start of construction of the Quabbin Reservoir and the Ware River intake.

The Ware River intake works in South Barre and the Coldbrook-Wachusett aqueduct were completed in 1931. In that year, approximately thirteen billion gallons of water were diverted from the Ware River to the Wachusett Reservoir.

3.2 Ware River Intake Works

Roger Lonergan Intake Works, Shaft #8

The Roger Lonergan Intake Works is located on the south side of Route 122 about four miles east of Barre center, in the Ware River at the point where the river passes over the Quabbin aqueduct. The Intake Works are designed to divert water from the Ware River through Shaft No. 8 into the Quabbin-Wachusett aqueduct for delivery to either the Quabbin or Wachusett Reservoirs. Diversion normally goes to Quabbin, where a baffle dam forces water diverted from the Ware River to flow around Mt. Zion before reaching Shaft 12, through which Quabbin's water flows to the Wachusett Reservoir. This design allows the highly organic water of the Ware River to be mixed and stored with the less organic water of the Swift River before passing to Wachusett Reservoir.

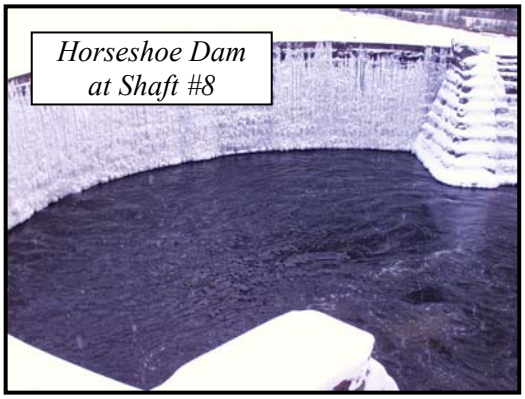
Diversion of water from the Ware River is subject to the following legal restrictions, under the Acts of the Massachusetts State Legislature Chapter 375, Acts of 1926:

- No water may be diverted from the Ware River on any day when the natural flow of the river is less than eighty-five million gallons
- A total of eighty-five million gallons of water must be released down the Ware River on each day during which diversion takes place
- No diversion shall take place during the period between May 31 and December 1 in any year unless such diversion is first approved by the State Department of Public Health

An additional restriction, under a decision of the War Department, states that no diversion shall take place during the period between June 15 and October 15 of any year. This has been interpreted to mean that diversion must stop at midnight on June 15 and cannot be resumed before midnight on October 14 of any year.

The Intake Works at Shaft No. 8 are a siphon system. Water is drawn from above the dam into the intake works through six siphon spillways. From the spillways the water enters the valve pit where four butterfly valves are mounted to regulate the amount of water entering the shaft. The large metered valve has a capacity of 620 million gallons daily, while each of the three unmetered valves has a capacity of slightly less than 600 million gallons a day. The total capacity is slightly less than 2.4 billion gallons daily. The valves direct the water onto cast iron plates with helical vanes mounted on the walls of the shaft. Centrifugal force maintains a smooth discharge of water from the valves around the circumference of the shaft. The water can then be gravity-fed through the aqueduct in either direction.

3.3 Surface Waters


Horseshoe Dam at Shaft #8

The impoundment at Roger Lonergan Intake at Shaft No. 8 in Barre is classified as a "run of the river reservoir." Residence time is short and the water maintains the character of river water. The Ware River derives its character from water inputs from Barre Falls Dam, the Burnshirt River, Natty Pond Brook, Parkers Brook, subsurface flow from forestland, and small amounts of overland runoff from impervious surfaces in the watershed. Each of these inputs contributes markedly different qualities to the water at the Intake.

Barre Falls Dam is a flood control facility managed by the U.S. Army Corps of Engineers. Typically, it holds back the peak flow in the spring and then discharges it gradually. Dissolved oxygen can decrease in the impoundment, especially if leaf-out occurs before water levels return to normal pool. However, substantial aeration occurs by way of a mile-long rocky ravine immediately below the dam. The Burnshirt River, Canesto and Natty Pond Brooks combine and enter the Ware River below the ravine. Normal, unimpeded flows through the dam are high in dissolved organic compounds (DOC) and color, derived from the peaty meadows of the East and West Branches of the Ware River above the dam. Extensive peat deposits along Natty Pond Brook contribute significant color and DOC and decrease dissolved oxygen. These qualities are somewhat reduced through mixing with waters of the Burnshirt River and Canesto Brook.

Parkers Brook follows Route 122, crossing it several times. Numerous direct road runoff channels from Route 122 may contribute metals, salt and sediments. Route 122 also follows the Ware River from below Parkers Brook to the Intake, with the same channelized road runoff. For the most part, however, the river flows through Division-controlled properties on the Ware River watershed, which are predominantly forested except for a network of gravel roads.

Besides the impoundment at the Intake, which has already been described as having river-water character, the Division owns or controls many small dammed ponds. These ponds may exert some influence over downstream water quality, but they were built for other purposes, such as mill ponds. While their locations may not be ideal, they are perceived to contribute positive qualities to the water, such as reducing dissolved organic compounds.

3.4 Water Yield

Historically, growing demands on Boston's water supply system led to repeated efforts to develop land management strategies that would increase water yield. In the past decade or more, the MWRA has devoted considerable efforts to demand management, and the overall system demand has significantly decreased since 1988, primarily due to water conservation efforts. The MWRA has stated that demand is projected to remain below safe yield of the system for the immediate future. This condition may be influenced by significant droughts, increased pressure to add new users to the system, and economic pressures to generate revenue. While water quality considerations will drive management decisions for this 2003-2012 Ware River Land Management Plan, water yield will remain an important consideration in land management planning.